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PERFECTING WAR: THE SEARCH FOR A TECHNOLOGICAL
SOLUTION TO A HUMAN ENDEAVOR

by

Eric J. Schnitzer, LtCol, USAF

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ABSTRACT

This paper discusses the role of technology in war. War is a uniquely human endeavor. Technology offers the promise of easy victory. Humans are perceived as messy and difficult to control, while technology is perceived as clean and easy to control. This paper explores both human and technology impacts on warfare in the past, present, and future. The challenge for military strategists is to understand the correct emphasis to put on technology while pursuing a human outcome.

Chapter 1

Introduction

The United States military is inexorably wed to technology. Current military technology is absolutely required to successfully prosecute modern wars. However, no amount of high-tech weaponry and command and control systems can guarantee success in war. War is inherently a human endeavor and as such is subject to human imperfection.

War is also unique among human endeavors and creates unique circumstances that, despite all attempts, cannot be overcome with technology alone. Over the course of history, warriors have used technology to gain an edge over their opponents. Many times, technology has delivered victory, but, “there are no mechanical panaceas.”¹ War is violence conducted by human organizations in order to secure human goals. In war, technology is an enabler, but not an end in and of itself.

The U.S. has enjoyed a technology advantage in warfare since the end of World War II. This advantage has been extremely evident since the 1991 Gulf war and through Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom. Many military experts point to American technological superiority as the deciding factor in these conflicts.

This tendency to credit technology with winning wars is deeply imbedded in American culture. Americans think that there is a technological fix for everything.² This opinion can lead

to disaster when taken to the extreme of believing that technology can be used to perfectly execute war.

This paper will put forth a definition of war, then describe the role of technology in warfare, explore the technology imperative, the human reality, and demonstrate the fallacy of creating perfection in war with technology.

Chapter 2

War, Some Definitions

The ancient Chinese General, Sun Tzu, said that “in order to attack the enemy’s strategy, we must understand the enemy and we must understand war.”³ In order to understand what war is, one must understand who makes war, as well as how and why they go to war. Prussian General Carl von Clausewitz described war as “nothing but a duel on a larger scale” and more completely that war is an act of force to compel our enemy to do our will.⁴ An even more comprehensive definition of war is that it is a conflict between or among state and state-like entities for political control over people, territory, or resources.⁵ This definition covers all the questions of who, what, and why, and as long as one interprets conflict as violent force, the how as well. Violence is what turns conflict into war.⁶ Each portion of the definition is important so as not to confuse war with other human interactions.

The “who” of war is very important. A single individual using violence to impose his will does not qualify as a war. This is merely a human activity. In many societies, such behavior is criminal. In others, it is accepted in varying degrees. A gang of criminals using violence is not war, despite references to “gang wars.” The object of political control must be present. Wars are fought by individuals, but those individuals are fighting as part of something larger than themselves. They are fighting for their state, ethnic group, or society. “Societies go to war,”⁷ not individuals acting alone.

In order to impose political will on an enemy, the group going to war must be a political entity. This is why the definition includes state-like entities as well as states. State vs. state wars fall easily into this definition and are the subject of most of history. States are the most widely accepted participants in war. Indeed, states are optimized to wage war as the ultimate test of their first duty—the protection of their citizens and territory.

The more thorny part of the definition is the state-like entities. This includes societies formed from ethnic or racial groups that congeal in order to break away from a state or impose their will upon the state. According to Martin Van Creveld, “in the future, war will not be waged by armies but by groups whom we today call terrorists, guerrillas, bandits, and robbers...motivated less by “professionalism” than by fanatical, ideologically-based, loyalties.”⁸ Van Creveld’s “bandits and robbers” can make war when they work toward political control as opposed to thievery.

These ideologically-based entities evolve in wars of legitimacy, where certain groups believe that the “state no longer symbolizes their society.”⁹ These societies then resort to violent opposition in order to impose their political will upon the state. Insurgents are the most common example of state-like entities in war.

States and state-like entities make up the “who” of war. An individual cannot make war on his own; however, individuals are at the very heart of war. “Wars are the sum of battles, battles the tally of individual human beings killing and dying.”¹⁰ War is the realm of individual and group violence.

Violence is what war is. Sir Michael Howard explains that “trade wars and tariff wars may involve conflicting interests, but unless there is an element of organized, sanctioned and purposeful violence, these are not war.”¹¹ Although war will involve all the elements of national

power (diplomatic, economic and informational as well as military),¹² it is the use of violent force that distinguishes war from other political discourse.

This purposeful violence is at the heart of war and is why societies form militaries. It is the killing and dying that separates war from other human endeavors and creates the need for specially trained individuals and groups to prosecute war. Ralph Peters put it bluntly, “Our security can never be bought solely with money or even with the most skilled diplomacy, and it certainly cannot be secured with good intentions. A healthy state must cultivate a discriminating appetite for killing.”¹³ Organized militaries carry out that killing for the state. Militaries organize, train, and equip in order to survive in Clausewitz’ climate of war. “Four elements make up the climate of war: danger, exertion, uncertainty, and chance. If we consider them together, it becomes evident how much fortitude of mind and character are needed to make progress in these impeding elements with safety and success.”¹⁴

Militaries, professional or not, are what states and like entities use to prosecute the violence in war, but violence is not the object of war. “*Combat* is characterized by braking things and killing people; *war* is about much more than that.”¹⁵ Purposeful violence is the “what” of war, but not the why. Violence is merely an instrumental goal, not an end in itself.

Violence, death, dying, and destruction are not the ends that state and state-like entities seek in war. Their goal is to impose their will on their enemy. To this end, the “why” of war is to gain or maintain political control over people, territory, or resources. As Clausewitz explains, “war is simply a continuation of political intercourse, with the addition of other means.”¹⁶

If war is politics, why do states and like entities resort to war and not continue non-violent means to achieve their ends? Perhaps war is forced upon them, or they believe they have exhausted every other means, or they believe that it is their only choice or even that war is

preferable (more honorable) than diplomacy. Societies that wage war are demonstrating that the cost of violence is better than an unacceptable condition of peace. Victor Davis Hanson asserts that war may be appealing because “there is an inherent truth in battle. It is hard to disguise the verdict of the battlefield, and nearly impossible to explain away the dead, or to suggest that abject defeat is somehow victory.”¹⁷ But Philip Bobbitt asserts that states resort to force based on cost/benefit analysis, asking themselves if the state will be better off in the future if it resorts to force to get its way.¹⁸

Typically, states go to war for the security of their people. State-like entities use the logic of state oppression to go to war for the perceived security of their people as well. Martin Van Creveld asserts that “the most important single demand that any political community must meet is the demand for protection....The rise of the modern state is explicable largely in terms of its military effectiveness vis-à-vis other warmaking organizations.”¹⁹ In the case of an aggressor nation, Phillip Bobbitt offers that a war doesn’t start until the aggressor is opposed, “as a general matter, it takes two states to go to war.” This occurs “when a state determines it cannot acquiesce in the legal and strategic demands of the aggressor [state].”²⁰

Security is the goal of war, and security is enhanced by political control over people, territory, or resources. Therefore, states and like entities resort to violent force to gain political control, the “why” of war. Von Clausewitz says of war, “to impose our will on the enemy is its object...If the enemy is to be coerced you must put him in a situation that is even more unpleasant than the sacrifice you call on him to make.”²¹ People band together in state and state-like entities for collective self-interest. These entities use violence to place their enemies in unpleasant situations in order to gain or maintain political control over people, territory, and resources.

State to state warfare as characterized by World War II clearly fits into this definition. The allied and axis powers qualify as states that used violent conflict in order to achieve political control. In many cases this meant *regaining* political control.

Insurgency, as in the Vietnam War fits the definition of war as well. The Viet Cong insurgents were the state-like entity using organized violence to gain political control. Their methods that attacked non-combatants were illegal under the laws of war, but that does not disqualify this as war.

As explained by Sir Michael Howard above, trade and tariff “wars” do not fit the definition because there isn’t any organized violence, despite the conflict between states for political control of resources and trade.

The U.S. “War on Drugs” is not a war. The illegal drug organizations are not state or state-like entities and they do not seek political control, merely profit from their merchandise. The U.S. government may resort to violence, but it is used to stem criminal activity, not gain political control.

The U.S. “Global War on Terrorism” does not technically fit the definition. Terrorism is a method, an act of violence, not an entity.²² However, it could be argued that al Qaeda is a state-like entity and that the U.S. has made war with al Qaeda. There are many criminal activities and crime prevention aspects of the conflict between the U.S. and al Qaeda that detract from its classification as a war. Also, perhaps the political control that al Qaeda seeks is more of a “king maker” role than as the sitting political authority. This is demonstrated in their backing of the Taliban in Afghanistan, but rejection of the Saudi royal family. But with all of those minor variations, the U.S. conflict with al Qaeda could be seen as meeting the preceding definition of

war. Operations Enduring Freedom and Iraqi Freedom, where the U.S. fought forces in control of those states, were definitely war.

Where does technology fit into the definition of war? The answer is, it doesn't. Technology of any kind is not necessary for the required violence to meet this definition of war. Technology is an enabler for the organized, sanctioned and purposeful violence of war, but not a requirement. A war could be fought with the belligerents' bare hands and still qualify under this definition. As John Guilmartin put it, "whatever the technology, war remains as Carl von Clausewitz characterized it, a test of will and faith."²³

Chapter 3

Technology and the Evolution of War, Past Present, Future

Although technology is not required to meet the definition of war, it has an appeal that makes it integral to the execution of warfare. It could easily be argued that although technology is not needed to meet the definition of war, technology has elevated the violence of war so high that unarmed violence is not violent enough; technology is necessary to make war. Sun Tzu said that “war is the province of life and death”²⁴ and technology has increased our ability to kill to such a high level that it is indispensable to the conduct of warfare. Even so, as each new technological advance in warfare is introduced, the old technology is still useful in some way. Weapons rarely lose some measure of lethality. A Bronze Age knife can still kill. But we seek ever more sophisticated technology—a quest for the “silver bullet,” to more readily vanquish our enemies.

In the past, advancements in technology were the result of warriors searching for a perfect weapon. From the first time that a warrior picked up a stone in order to hit his adversary with it, we have been enamored with the power that technology brought to the battle. Soon warriors learned to sharpen the stone for more violent effect. They also learned to throw the stone to increase their own safety while still causing damage to their enemy. This was followed by improvements such as metal weapons for hardness, mass, edge, and resilience. We also developed bows to sling a weapon and achieve even greater standoff distance.

Each advancement in technology promised to increase a warrior's ability to kill and survive, or remain safely out of range of his enemy. The sword increased a warrior's reach, the chariot his maneuverability (swiftly move in to attack then back out of reach). The longbow was the pinnacle of archery but it was replaced by firearms which offered the same standoff but with the added benefit of a psychological effect from the noise and a diminished training requirement.²⁵ Firearms led to the big guns of artillery, developed for more destruction and longer range. These tools of war were ripe for improvement when the world entered the industrial revolution.

The dawn of the industrial age brought mass to war. Due to improved production and the introduction of railroads, it brought masses of people into armies to pull the triggers on weapons, and it brought the technology of mass production to provide mass amounts of triggers to be pulled.²⁶ World War I, the Great War, with its earth shattering amount of death and destruction triggered a demand for change. As before, warriors sought that change in technological solutions that gave birth to armored fighting vehicles, submarines, and aircraft. These again were technological attempts to improve destruction while keeping friendly warriors safe, either by standoff range or by deflecting enemy blows with armor. The search for the perfect, ultimate weapon continued. As Sir Michael Howard explains, "the expectation was that military technology would make the skills and virtues of the warrior unnecessary. The enemy, his military forces as well as the supporting society, could be destroyed at long distances from positions of comparative safety."²⁷

At all times during the growth of technology in warfare an arms race raged. As soon as one State enjoyed a technological advantage, another sought a way to counter or overcome it. John Guilmarin explains that in early warfare, "the copper-headed mace in the hands of a

powerful champion remained the world's premier weapons system for a very long time, but then as now both technology and the political ends to which it was applied were subject to change.”²⁸ This was accelerated during the industrial age as reflected by the Franco-German conflict of the late 1800s. Each side in that conflict would devise “ingenious weapons and occasionally achieved momentary superiority, only to be amazed at how quickly the other side acquired “an even more rapidly firing rifle, cannons that shot even farther, and shells that were even more effective.”²⁹

As discussed above, that technological arms race led to the devastation of World War I, but the solution was to attempt to find even better technology to counter what was used in that war. According to retired USAF Major General I. B. Holley, “the events of World War I abruptly focused attention upon the relative significance of materiel in securing victory.”³⁰ An advocate for technology, General Holley asserts that “superior weapons favor victory down through World War II.”³¹ He goes on to assert that “Clausewitz wrote after the Industrial Revolution was well under way, but his writings show an utter lack of appreciation of the implications for the development of weapons in the new mechanization.”³² It can be argued that he is correct, for in World War II, we finally created the ultimate weapon. The atomic bomb promised massive destruction while enabling, especially when combined with intercontinental ballistic missiles, huge standoff ranges. Finally, the world had a technological marvel of a weapon where one side could push a button from the safety of their homeland and annihilate their enemy.

Nuclear weapons create the reality of war in the present. But that reality is not how to best use the ultimate technological weapon, but how *not* to use it or have it used against us. After World War II, the constant arms technology race ensured that the U.S. did not have a

nuclear monopoly for long. But even during that time of massive technological superiority, the U.S. did not desire to use the nuclear weapon again. The amount of destruction was too high, even for an enemy. Once the Soviet Union acquired nuclear capability, even though the U. S. had a policy of massive nuclear retaliation, Bernard Brodie was correct to state that “thus far the chief purpose of our military establishment has been to win wars. From now on, its chief purpose must be to avoid them.”³³

To illustrate that even the fearsome destruction of nuclear weapons is not unique, an interesting parallel can be drawn here with Greek fire. Greek fire was a sort of flame thrower that the Byzantines used circa 700 AD. It was such a destructive weapon that they only used it to protect the capitol for fear of proliferation. Alex Roland asserts that eventually, “so successful were they in keeping the secret (of Greek fire) that it finally became, I am convinced, secret even to them.”³⁴

Fear of reprisal kept the Byzantines from using Greek fire, and it also keeps the major powers from using nuclear weapons, but it does not stop wars. As Phillippe Delmas asserts that “Since war among themselves was now impossible, the world powers waged it elsewhere, and with increased ferocity. There was no such thing as ‘nuclear peace.’ Wars actually continued everywhere—only *nuclear* war was averted.”³⁵ Technology had produced a weapon so destructive that no one dared use it in war. If one or both sides were annihilated, then the ultimate goal of war, political control or as Clausewitz put it, to impose our will upon the enemy, is unachievable. Perhaps Clausewitz was correct to not include technology in his treatise on war. For when the ultimate weapon doesn’t allow you to achieve your political goal in war, then you must not use it, and yet, wars continue.

Warriors once again turned to technology for the solution to winning wars without using nuclear weapons. The technology that they pursue is still dealing with maximizing destruction while increasing standoff and protection. That destruction is now achieved through precision weapons. The standoff is achieved with longer range weapons and stealth. Elinor Sloan describes precision weapons as third-wave and claims that in 1991 Operation Desert Storm was really two wars. “One war was fought with second-wave weapons designed to create mass destruction, while another war was fought with third-wave “smart” weapons designed for pinpoint accuracy, customized destruction, and minimal “collateral damage.”³⁶ She goes on to state that in the first Gulf war military leaders “came to understand the remarkable increase in military capability that the new technologies would provide.”³⁷

The new technologies of stealth and precision are at the heart of a system of warfare called parallel war that aims to paralyze and enemy without annihilating that enemy at the same time. Jeffrey Barnett claims that “while this concept has long been envisioned by strategists in theory, advances in technology are currently enabling its prosecution in reality. Aerospace forces will soon be able to engage hundreds of targets within the first hour of a conflict.”³⁸ This massive attack is planned in order to produce an effect on the enemy, not just to cause destruction. These effects will eventually force the enemy to submit to the attacker’s will, thereby giving the attacker the political control that he seeks. The key to this application of precision force is to attack the correct targets in order to achieve the desired effects.³⁹ Future war will be fought with technology that is being designed to accomplish that goal.

The technology of future war will build on precision in order to apply force to the correct targets to achieve the desired effects. It will also continue to work toward further standoff and

safety for friendly combatants. The technologies that will accomplish those goals are network-centric warfare and uninhabited vehicles.

Network-centric warfare will allow for precise application of weapons though increased, shared knowledge of the enemy and collaboration among all services and coalition partners. It will also allow for standoff due to the fact that the “reachback” of shared knowledge in the Global Information Grid makes location of decision makers less relevant.⁴⁰ Therefore, they can be farther away from the geographical location of the war violence while being virtually close to the action and able to impact the outcome. Jeffrey Barnett asserts that the Joint Force Air Component Commander (JFACC) “for theater war should remain in CONUS. Basing the JFACC in CONUS would avoid creating a fixed, in-range, high-value target for the enemy.”⁴¹ Network-centric operations will allow this to become a reality without impacting the JFACCs mission accomplishment.

The vision for military use of network-centric technology describes how the infrastructure for information, or infostructure, fuses and links sensors and data to provide a vastly improved shared battlespace awareness that leads to self-synchronization of people through virtual organizations and collaborations. This allows for a substitution of information for people and material. Taken together, network-centric warfare leads to a bottom line of an “increased tempo of operations, increased responsiveness, lower risks, lower costs, and increased combat effectiveness.”⁴²

NCW will keep the majority of decision makers safely away from geographical operations, however, some platforms will need to get close enough to the enemy to perpetrate violence upon him. If our platforms are close enough to reach out and touch the enemy, then they may be able to perpetrate violence on our platforms in return. The technological solution to

this problem is to make the platforms uninhabited. This strips the enemy of any ability to cause the friendly side any human harm. According to Jeffrey Barnett, in future air warfare, “we need to think in terms of tens of thousands of UAVs (unmanned aerial vehicles). Their inherent stealthiness and minimal basing requirements allow low-signature operations. Their lack of an aircrew allows casualty-indifferent operations.”⁴³ UAVs will allow our warriors a great amount of standoff while prosecuting warfare.⁴⁴ Technology has thus increased both destructiveness and standoff in war.

Chapter 4

The Technological Imperative

The appeal of the technology solution in war is not just that it is required to prosecute war, it also has great appeal because it works. Throughout history there are numerous accounts of technological solutions lending an overwhelming edge to one side or the other. Guilmartin's warrior with his copper-headed mace was unbeatable when he first ventured into battle.⁴⁵ That may have been the very first example of technological superiority winning on the battlefield, but other examples abound.

The Byzantines use of Greek fire was such an overwhelming successful technological marvel that they "hardly dared use it."⁴⁶ The highly technologically equipped French Knights did not stand a chance against the precision and standoff of the English longbow at Agincourt. Artillery destroyed medieval fortifications. Repeating rifles and machine guns destroyed colonial resistance around the world. The introduction of the armored tank produced significant success at Cambrai in World War I. It was even more lethal when combined with aircraft in the German blitzkrieg of World War II. The atomic bomb brought the war in the Pacific in World War II to a conclusion. And the U.S. application of precision and standoff in the form of smart bombs and stealth was overwhelmingly successful against the Iraqis and Taliban in Operations Desert Storm, Enduring Freedom, and Iraqi Freedom.

Enduring Freedom and Iraqi Freedom have also given the world a glimpse of the promise of network-centric war. As Max Boot explains, “the US military operates a bewildering array of sensors to cut through the fog of war...now, troop deployments are displayed on digital screens, with friendly forces shown in blue and the enemy in red...this wireless Internet system...gives U.S. commanders much better knowledge of the battlefield than their enemies possess.”⁴⁷

Current and developing technologies are gaining accolades from numerous sources as the single biggest factor in winning at war. Standoff, precision, and integration technology provide U.S. forces with the ability to conduct “a (massively) parallel series of synchronized integrated operations conducted at high-tempo, with high lethality and high mobility, throughout the depth and extent of the theater, intended to force the rapid collapse of both the enemy’s military power and the enemy’s will.”⁴⁸ Airpower theorist Benjamin Lambeth agrees that technology has transformed air power to a violent force in warfare that “saves lives—enemy lives through the use of precision to minimize noncombatant fatalities, and friendly lives by the substitution of technology for manpower and the creation of battlefield conditions in which land elements... can do their jobs without significant resistance.”⁴⁹ Throughout professional military material, there is much agreement with the prominence of the dominance of technology in war predicted by Baron Jomini in 1836: “the means of destruction are approaching perfection with frightful rapidity.”⁵⁰

The next step in technological evolution is to focus on network-centric warfare (NCW) technology in order to move “from improving the individual elements of combat power...to integrating and focusing the power of the ‘whole.’”⁵¹ Network-centric warfare technology is seen as the instrument that will provide the “responsiveness and agility [that] are fast becoming the critical attributes for organizations hoping to survive and prosper in the Information Age.”⁵² NCW will increase the tempo of operations on the traditional battlefield as well as providing the

infrastructure for conducting information operations in war. Information operations are going to increase in importance in warfare, “more than ever, conflicts will revolve around “knowledge” and the use of “soft power.”⁵³ One advocate of information warfare asserts that “defeating the collection or dissemination of the information [upon which the ‘shooters’ will be so dependent for effective strikes] will be tantamount to destroying the attacking platform itself.”⁵⁴

Network-centric warfare technology advocates assert that the U.S. military must change its organization and focus in order to capitalize on these new capabilities. Jeffrey Cooper states that due to networking, organizations are “relieved of the classic span-of-control constraints by new technologies, [therefore] organizational structures are being flattened and managers are being refocused to improve rather than impede flows of critical information.”⁵⁵ This fits in well with the viewpoint that “modern IT does ensure that the fog of war can be lifted, and suggests that the U.S. military must be radically transformed in order to optimize its capabilities in an information warfare-dominant future.”⁵⁶

The extremist belief that technology solutions always work in war leads to the conclusion that the side with the greater technology will win and further, that militaries must radically change in order to accommodate the latest technology. There is danger in too much belief in the wonders of technology. The problem occurs not in the attempt to “to leverage technology in the pursuit of revolutionary change, but in technocratic thinking: the belief that an edge in technology itself is enough. Technocratic thinking can lead to a dangerous de-emphasis of other factors critical to success in war.”⁵⁷ Perhaps this is why the U.S. National Military Strategy, in focusing transformation, only has one of eight categories that does not imply technical modernization.⁵⁸ This may also be why the Defense Advanced Research Projects Agency (DARPA) is designated as the “technological engine for transforming DoD” due to it being an

entity “whose only charter is radical innovation.”⁵⁹ Finally, technocratic thinking may be why the latest version of the directives for joint learning objectives omits the requirement for officer education in science and technology issues.⁶⁰ If all technology is good, then there is no need to study any issues on how it impacts warfare.

The need to transform the military due to technology innovation derives from a concept that doctrine is derived by determining how to best use technology.⁶¹ In other words, technology favors victory and when it doesn't, it was a failure to adopt correct doctrine to exploit the technology. General Holley asserts that “the hardware requirement inexorably imposes a *procedural requirement*. Military users must not only make decisions as to what organization will employ the new weapon but must also begin to devise tactics and techniques appropriate for the fullest possible exploitation of its capabilities.”⁶² Jeffrey Barnett echoes this sentiment for the need to change in the Air Force, “aerospace forces must devise radically different CONOPS and supporting organizations to realize the full potential of the coming radically new technologies.”⁶³ These positions tend to support the concept that doctrine is merely the correct application of technology in war. This doctrine will enable the military to correctly apply the power of network technology as well. The U.S. National Military Strategy implies that with the correct doctrine,

The joint force will use superior intelligence and the power of information technologies to increase decision superiority, precision and lethality of the force. A networked force capable of decision superiority can collect, analyze and rapidly disseminate intelligence and other relevant information from the national to tactical levels, then use that information to decide and act faster than opponents.⁶⁴

The technological imperative in war drives the concept that doctrine is enumerating the best way to employ new technologies in order to unleash their inherent ability to win.

If doctrine is employing technology correctly, then what is strategy? In technocentric terms, strategy is targeting. This derives from the fact that the U.S. military believes that technology gives it the ability to strike any target anywhere on the globe. Dr. Grant Hammond explains that “the syllogism runs something like this: Strategy equals targeting. The number and nature of targets destroyed best measure success. When all the targets are destroyed, the war is over.”⁶⁵

The U.S. Air Force, which is completely reliant on technology to operate in its medium, states that “airpower is targeting.”⁶⁶ This concept is good for the employment of USAF forces since technology drives doctrine and technology drives the concept that strategy is targeting. The future of the strategy as targeting concept is assured in the future of military transformation and effects based operations. On transformation, Frederic Kagan explains that “the entire thrust of the current program of military transformation of the U.S. armed forces, on the contrary, aims at the implementation and perfection of this sort of target-set mentality.”⁶⁷ Writing on how to plan effects based operations, Lt Col John Hunerwadel instructs that a plan should “identify the targets or target sets the campaign will aim at from an effects-based perspective: desired effects, targets, and measures of effectiveness. It should prioritize among those target sets and resolve sequencing and synchronization issues. It should determine the relative level of effort to devote to each target or set.”⁶⁸ Transformation and effects based operations will continue to support the technology driven notion that strategy equals targeting.

The technologies of NCW and uninhabited vehicles will also enable another concept of correctly using technology. That concept will be centralized control and centralized execution. Although NCW promises “decentralization that will in turn allow the C2 process to be more agile and able to deal with change, complexity, and uncertainty,”⁶⁹ it actually affords the

decision makers the capability to shrink distance and personally direct operations. Jeffrey Barnett predicts that due to the need to deconflict multiple weapons systems, “future aerospace operations will require increasingly *centralized execution*,”⁷⁰ and that NCW technology will make that possible.

With the “Shared Awareness” and “Shared Understanding” that the networked C2 system of the future provides, the only decentralization is the geographical location of the C2 nodes. The Common Operating Picture is not a centralized geographic entity, but it is a centralized view of the battlespace. In other words, if the shared awareness and understanding presented in the COP is incorrect, everyone gets the same bad information. One bad node can input bad information in its sphere of responsibility and impact the entire COP. Conversely, the common Operating Picture gives upper echelon commanders the capability to direct the actions of their subordinates in real-time without ever leaving the United States. According to Kagan, this is the path that we are going down. He deduces that “the notion that the U.S. should ‘be able to run a conflict without ever leaving the United States’ is deeply embedded in the plans and programs of the Bush administration.”⁷¹

However, the military NCW community is advocating a different system for control based on the capability of NCW technology. In their view, the “The most promising approach (to control in NCW) involves establishing, to the extent possible, a set of initial conditions that will *result* in the desired behavior. ... Instead of being *in control*, the enterprise creates the conditions that are likely to give rise to the behaviors that are desired.”⁷² In other words, despite their ability to communicate instantaneously with subordinates, defense leaders should use the power of network technology to put their intent out on the net and trust that the technology will produce results. This community also eschews detailed planning in favor “a fundamental shift in

the approach to strategic planning. ... to the recognition that we need a robustly networked force to be able to deal with situations as they arise.”⁷³ This tends to reinforce the technocentric ideal that there is no need to plan, the technology will ensure that we win.

However, the NCW community has named the only obstacle to building the perfect, winning technical force. According to the DoD Command and Control Research Program, “Given the significant advances in technology, the primary barriers that remain are cultural and institutional.”⁷⁴ In other words, technology isn’t the problem, people are the problem.

Chapter 5

The Human Reality

But war isn't about technology, it is about humans. War is about political entities employing violence to achieve political goals. Humans must be involved in forming the political State and State-like entities and control over human behavior must be achieved in order to achieve a political goal. States were formed by people to fulfill their need for security and any state that cannot protect its citizens from crime nor protect its homeland from attack by other states would have ceased to fulfill its basic reason for being.”⁷⁵ One doesn't win wars by crushing an opponent's technology, one wins wars “by steadily reducing an opponent's physical and mental capability to resist, one ultimately crushes his moral will to resist as well.”⁷⁶

Technology may be required to achieve that goal, but even Guilmartin's prehistoric warrior with his copper-headed mace hero understood implicitly that success in war was determined not just by strength and technological advantage alone, but by the effective application of those qualities in human context.”⁷⁷ Chinese general Sun Tzu understood that human element as well. He taught warriors to “seize that which your adversary holds dear or values most highly; then he will conform to your desires.”⁷⁸ Take note that Sun Tzu did not say “destroy what your adversary holds dear,” for he understood that war involved putting humans in situations that are worse than giving in to their opponent's political desires.

Colonel John Boyd reiterated this philosophy well when he stated, “machines don’t fight wars. Terrain doesn’t fight wars. Humans fight wars. You must get into the mind of humans. That’s where the battles are won.”⁷⁹ Were he alive today he might be inclined to add that information networks don’t fight wars as well. His point is that war is a human endeavor; one must never become so enamored with technology as to lose that overarching concept. Mao Tse-Tung took that understanding one level further, he “firmly believed that a weak army could win in a war against a strong enemy because he was convinced that ‘man’ could beat ‘weapon.’”⁸⁰ Although it may seem pure fantasy to imagine an unarmed man winning against a tank, that is analogous to the type of asymmetric warfare that could be a weakness for a technologically advanced military that treats its enemies as target sets.

That men in modern warfare are in service to technology since they may “never actually see the people they are firing at nor those firing at them”⁸¹ may be a truism. However, as Frederick Kagan eloquently states, “it is a fundamental mistake to see the enemy as a set of targets. The enemy in war is a group of people. Some of them will have to be killed. Others will have to be captured or driven into hiding. The overwhelming majority, however, have to be persuaded.”⁸² He also asserts that machines and bombs cannot accomplish the territorial and population control necessary to achieve that persuasion. “Only human beings interacting with other human beings can achieve it. The only hope for future success in the extension of politics that is war is to restore the human element to the transformation equation.”⁸³

Technology is an excellent tool for achieving destruction, but as Clausewitz explains, “the destruction of the enemy is not the only means of attaining the political object.”⁸⁴ Technology focuses on targeting and destruction to inflict violence. Humans must control the

violence to achieve the political goal. Controlling the violence inherent in war can be very difficult due to the unexpected and unavoidable problems that appear in combat.

Clausewitz explains that “war is the realm of danger...physical exertion and suffering ...uncertainty...chance” where everything “in war is very simple, but the simplest thing is difficult.”⁸⁵ These difficulties cause the “fog and friction of war.” One aspect of technological advancement is the desire to eliminate the impact of fog and friction on combat operations.

Information technology is seen as a way to cut through that fog and friction. Barry Watts contends that “what can be said with confidence, though, is that by reducing the aspects of friction we have been discussing with improved information systems, friction will probably manifest itself in other ways or in areas that we may not even be able to predict.”⁸⁶ This is not to say that information technology should be slighted, only that the human element must be taken into account. Warriors will continue to welcome an increase in pertinent information, however; they must not rely on normally perfect systems to be 100% correct in war. “Rather, in armed conflict no success is possible—or even conceivable—which is not grounded in an ability to tolerate uncertainty, cope with it, and make use of it.”⁸⁷ It takes a human mind to accept risk and cut through the fog of war. John Boyd understood that war is the realm of uncertainty where fog and friction are part of the territory and make war an “art, not science, and highly dependent on morale, perception, and attitude as well as aptitude.”⁸⁸

Warriors such as Boyd use technology as a tool to reduce and adapt to the fog and friction while maximizing and exploiting the friction felt by their opponents.⁸⁹ They use fog and friction to their advantage. They understand that “general friction will continue to be central to future warfare regardless of technological changes in the means of combat.”⁹⁰

In order to use technology as a tool, humans must learn how to use that tool. This is how Boyd and other warriors taught the art of war. They believed that “anyone who aspires to master the strategic art must understand the challenges and opportunities afforded by technology.”⁹¹ This human mastery of both the opportunities and challenges requires an investment not just in the technology of war, but also “greater attention to the thought behind the deployment and employment of military force and its ultimate purpose rather than on the tools of winning and losing.”⁹²

This lack of thought on the employment and purpose of war while relying on technology is subject to defeat. Philip Bobbitt asserts that all the high tech weaponry of the modern military actually make it impotent against insurgents and terrorists. “Against these threats, the nation-state is too muscle-bound and too much observed to be of much use. The mobilization of the industrial capacity of a nation is irrelevant to such threats; the fielding of vast tank armies and fleets of airplanes is as clumsy as a bear trying to fend off bees.”⁹³ Perhaps the most blatant example of humans triumphing over machines in war is the Vietnam conflict. U.S. strategy in that conflict relied on mass attrition and viewing the enemy as a set of targets, but the U.S. soon “discovered that strategy, as taught at staff and war colleges, was inadequate for understanding ‘a war without fronts,’ let alone for successfully waging it.”⁹⁴

As each technological advancement in war has been introduced, there has been a need to keep the skills that the new advanced technology was meant to replace or enhance. Sir Michael Howard reminds us that, “in spite of all the technology of the industrial and post-industrial age, does there not still lie at the core of all warfare a need to engage in the primitive encounters of the agrarian age? And was not the lesson of Vietnam that, if the capacity to do so disappears, no amount of technology is going to help?”⁹⁵

NCW advocates believe that providing more information to the human warfighter will be the key technology that opens the door to success in war. As networked information comes on line, it will have to be tailored to deal with the human reality of its intended recipients. As the military enter the Information in warfare age, it must remain aware of Elinor Sloan's caution that "increased information, or data, does not equate with increased knowledge and understanding – indeed, it could just as likely lead to sensory overload."⁹⁶ The critical skill remains strategic judgment, knowing what is important and choosing how best to proceed.

The amount of information available on the network will far exceed the ability of human decision makers to cope with and will be a source of fog and friction in and of itself. "Future strategic leaders will be overwhelmed with information, and winnowing out what is useful will be the challenge. Skill at this must be carefully and deliberately cultivated."⁹⁷ Two important human aspects of information sharing are filtering and reliability of information. Humans must have information filtered prior to their use, and they must be able to put a percentage value on how closely their information reflects reality. These two aspects of will be new sources of fog and friction in war. The algorithms that set the information filters and values will have a tremendous impact on decisions and actions.

Another human reality when dealing with constant, massive information flow is over reliance on that constant flow and confusion, inaction, and loss of initiative if it is cut off. Mao Tse-Tung would call this situation disarming the soldier and forcing him into a passive position, "both sides in war do all they can to gain the initiative and avoid passivity."⁹⁸ The Chinese military understands this human reality and is studying it at their Academy of Military Science. They believe that the weakness of digitized forces is that "if they fail to acquire or transmit information, digital forces will be paralyzed, their combat capability would shrink rapidly, and

they will lose the initiative on the battlefield.”⁹⁹ Chinese warfighters are investigating strategies to capitalize on the human weaknesses inherent in a highly networked military system.¹⁰⁰

One last aspect of networked information that merits mentioning is the fact that humans need human interaction and physical presence whereas the network offers ample opportunities for isolation through disconnected communication. But, people need other people’s physical presence to completely bond. Things go better face-to-face, plus tiny variations in body language, voice modulation, and intangibles are more quickly communicated in the close proximity setting. People have a deep psychological need for physical presence. Without that physical proximity some of the meaning of communication is lost. Against a willful opponent, that may mean the difference between success and failure.

James Gibson explains the power of human will over technology in war with a question about Vietnam, “Who defeated the most powerful nation in world history? Who defeated several hundred thousand troops equipped with the most advanced weaponry that the most technologically sophisticated nation had to offer?...For the most part, peasants of underdeveloped agricultural economies defeated the United States.”¹⁰¹ North Vietnam prevailed in the war without winning a major battle because they had a stronger will to win and sufficient military and strategic training. Thomas X. Hammes describes this as fourth-generation warfare, an evolved form of insurgency that attacks an enemy’s political will.¹⁰²

Military training cannot just be about how to best use the technology available, it must be about how to fight. Eugene Emme reminds military leaders that “training is more than a question of mechanical gadgets; it requires command decisions.”¹⁰³ It is human decision that translates into action that wins wars. Technology is merely the tool used to translate that thought into action, “for when all is said and done, it is as much by brains as by force that war is

fought.”¹⁰⁴ Training human beings in the art of war leads to success, but they must have the will to win as well.

Victor Davis Hanson, in studying Western military success throughout history concludes that “it was not merely the superior weapons of European soldiers but a host of other factors, including organization, discipline, morale initiative, flexibility, and command, that led to Western advantages.”¹⁰⁵ A host of human attributes are required to success in war. This is further verified when a non-Western nation adopts Western weapons technology, training, and tactics, but does not achieve success.¹⁰⁶

War is not about technology. It is about applying violence in a human context in order to achieve political control. As long as humans are involved, and they must always be, then there will be no perfection in war, no matter the technology.

Chapter 6

The Fallacy of Perfection

Humans aren't perfect and cannot achieve perfection. War is prosecuted by human institutions for control of human political ends. Technology exudes the illusion of perfection, but will never achieve it, either. Technology will always trace its roots back to imperfect humans working in an imperfect world. Technology in war tempts warriors with the fallacy of perfection based on increased destruction, precision, and the safety of standoff. But technology in war cannot achieve perfection; it can only become a highly efficient tool used by humans to prosecute violence in order to exert political control over other humans.

Even if technology achieved perfect efficiency and effectiveness, it would not be able to operate perfectly in war. War will never be perfect because it is illogical and efficiency does not directly translate into effectiveness. Martin Van Creveld remarks that when pursuing war, "the secret of the art consists of finding a correct balance between effectiveness and efficiency, two constituents that, at least as far as the world of strategy is concerned, are not complementary but actually opposed."¹⁰⁷ Thus, no matter how much efficiency technology brings to war, it can never reach perfect effectiveness. War is unique. It involves intentional killing and death. That is what makes it a continuation of politics by other/additional means. Van Creveld also offers that due to the need to employ deception, surprise, and diversion, "war differs from the physical world which constitutes the foundation of technology precisely in that two plus two do not

necessarily equal four, and that the shortest line between two points is not necessarily a straight one.”¹⁰⁸

Attempting to prosecute war based on scientific principles may lead to disaster, “since technology and war operate on a logic which is not only different but actually opposed, nothing is less conducive to victory in war than to wage it on technological principles—an approach which, in the name of operations research, systems analysis or cost/benefit calculation (or obtaining the greatest bang for the buck), treats war merely as an extension of technology.”¹⁰⁹

However, modern militaries must use technology in order to effectively (as well as efficiently) prosecute the violence inherent in warfare, there is a possibility to overemphasize technology. Since technology and war operate on differing logic, this overemphasis can detract from warfighting.

The lure of efficiency offered by new warfare technology exerts a powerful attraction on warriors. However, warriors must always remember that, “every new device and mode of war carries the virus of its own technical, tactical, operational, strategic, or political negation.”¹¹⁰ As General Hap Arnold said, “Today’s weapons are tomorrow’s museum pieces.”¹¹¹ Today’s technological marvel might easily fail in actual combat use. It could also be obsolete soon after it is fielded, overcome by newer technology.

But the major stumbling block of technology in warfare is that “even when properly integrated into weapons and systems with well trained and highly motivated people, (technology) cannot erase the difficulties that impede strategic excellence.”¹¹² As well as not being a substitute for strategic excellence, technology fixes can not diminish or erase the fog and friction, the main obstacles to perfection in war. “The map of fog and friction is a living, dynamic one

that reorganizes itself to frustrate the intrepid explorer.”¹¹³ But military technology is still appealing for what it does bring to the fight, overwhelming firepower and protection.

Technology has given the U.S. a superior ability to kill and safely standoff, but does the expectation of winning while remaining safe fail to achieve perfection. It may open a strategic seam for an opponent to exploit. According to Michael Howard, “Western societies have learned how to kill on an enormous scale, but they may still fight at a disadvantage against agrarian age armies who have not forgotten how to die and know well-enough how to kill.”¹¹⁴ The overemphasis on military technology may increase U.S. vulnerability in war. Increased violence and safety does not necessarily translate into the type of controlled violence that will compel an adversary to bend to our will.

Milan Vego echoes this concept by stating that due to its constant emphasis on technology, the U.S. “might find itself outthought and outfought by a relatively weaker but more agile opponent who pays attention not only to tactics, but also to operational art and strategy and therefore better matches ends, means, and ways to achieve victory.”¹¹⁵

There are signs that the U.S. military has taken this concept to heart. Current doctrine in the U.S. Air Force, the most technology oriented service, states that “the ultimate source of combat capability resides in the men and women of the Air Force. The value of strategy, technology, and organization is diminished without professional airmen to leverage their attributes.”¹¹⁶ However, the U.S. must not repeat the techno-centric mistake of the Vietnam era when strategic failure was blamed on not having enough technology or not employing it correctly. When the French lost at Dien Bien Phu, they were amazed that peasants on bicycles had beaten them. “The Americans were similarly amazed years later. They did not learn from the French because they thought that the French simply did not have enough tools of war; the

United States had many more.”¹¹⁷ With the current emphasis on network-centric warfare, one might wonder if there are warriors who believe that the U.S. would have triumphed in Vietnam if they had been equipped with NCW systems.

Sam Tangredi in studying consensus views of future wars offers evidence that many military officers believe that “the current focus on information dominance blinds us from the realization that the other elements of warfighting, such as maneuver and overwhelming force, are just as important.”¹¹⁸ This emphasis on information over other elements of warfighting has led to a belief that networking command and control systems will allow seamless application of both centralized command and centralized execution. In the words of Williamson Murray and Robert Scales in their study of air operations in Operation Iraqi Freedom, “to go down that road would be to follow in the disastrous footsteps of Robert McNamara and his minions in the 1960s. Whether commanders eager to control the battlefield themselves or lawyers desirous of limiting collateral damage (which they know little about) assume control at the center, such a result would be the end of flexibility and truly decentralized execution.”¹¹⁹ Centralized execution of decentralized operations would be the end of initiative as well as flexibility. It does not take long for a subordinate to become a passive weapon when his every action is dictated from above.

UAV operations in Afghanistan have already uncovered a propensity to elicit the centralized execution behavior from higher headquarters. Despite basic Air Force doctrine calling for decentralized execution, networked UAV “images also caused headaches for the commander of regular U.S. forces in Afghanistan who was overseeing the operation. Throughout the battles in the Shah-i-Kot region, command personnel at higher levels, and operating in other locations, relayed numerous questions and much advice to the commander in the field in an attempt to contribute to the management of unfolding battle.”¹²⁰ This is a prime

example that sometimes shared information and awareness is not conducive to successful operations in war. In the event, the overhead meddling did not impact the successful application of the subject mission, however, the result could easily have been different with a more capable foe. Multiple competing voices have a deleterious effect in war and contribute to fog and friction, not perfection.

The lack of a competent foe has lent itself to perpetuating the myth that technology can create perfection in the execution of warfare. The UAVs flying over Afghanistan were employed against nearly nonexistent defenses, “nor did the Taliban possess any capability to interfere with or attack U.S. computer networks.”¹²¹ The success of operations linking sensor and weapons platforms in Afghanistan was taken as a major example of the power of network-centric warfare advocates, but combat in Afghanistan only demonstrates that networking platforms is technically feasible in a low threat environment against a lesser foe.¹²²

Elinor Sloan claims that this incorrect deduction that superior technology was disproportionately responsible for victory was also applied to the 1991 Desert Storm campaign. She contends that “the one-sided coalition victory in the Gulf War was not technology per se but the skill differential between coalition and Iraqi forces.”¹²³ When one side outmatches the other in all skill levels, it may be easy to determine that superior technology made the significant difference. There is no substitute for an incompetent adversary. And for 30 years, from 1973 to 2003, the U.S. had not confronted one in combat.

However, one point that might illustrate why technology cannot perfect war is in the event of both sides in the conflict fighting with nearly equal technology. In this instance the side with the superior strategy and skill sets will win out over their seemingly equally matched opponents. Barry Watts makes the argument for this by focusing in on a force of fighter aircraft

fighting each other. When one side has datalinked network capability, it is more effective than its opponents. However, when both sides have network capability, they both have improved effectiveness, so “the relative margin of advantage will fall back to differences between the men in the machines.”¹²⁴ Technology will never create perfect execution in war because one side is never guaranteed continuous technological superiority.

Even with technological superiority, belligerents open themselves up to seams in their technology that an enemy may be able to exploit with lesser technology. This is the essence of an asymmetric attack. Many military thinkers are already envisioning ways to exploit networked U.S. information systems. Some believe that “the growing dependence on precise information for combat operations raises greater opportunities for deception.”¹²⁵ The Chinese military is willing to base their modernization on the fact that high-tech militaries can be blinded by their own dependence on information, they are working to “introduce counter-sensor technologies that can disable the key nodes of the adversary’s information network.”¹²⁶ The Chinese are developing additional methodology to counter network capability by “staging ‘soft’ attacks, against an adversary’s information or computer system as the basis of an asymmetric strategy, particularly against an enemy with greater conventional military capabilities.”¹²⁷

Martin Van Creveld explains that in warfare, an opponent or potential opponent studies every action and attempts to devise a way to counter it. In war “an action that has succeeded once will likely fail when it is tried for the second time. It will fail, not *in spite* Of having succeeded once but *because* its very success will probably put an intelligent opponent on his guard.”¹²⁸ This also applies to technology. Once it is used against an intelligent opponent it may not continue to keep its advantage as the opponent attempts to counter it.

But even if technology does bring about the ability to destroy any target at any time, that doesn't necessarily translate into accomplishing the strategic goal of the war. The violent application of power available to militaries due to technology must be used toward the desired political end. The impressive technical capability of the U.S. military has engendered the thought that it will always be able to achieve the strategic objective with military technological force. "The ability to take out a single building with a single bomb on a single pass fosters not only the expectation that this can be done routinely, but that to do so is strategically relevant."¹²⁹

Thinking of the enemy as a set of targets to be destroyed enables a military to develop technologies that increase their capability to find, fix, track, target, and engage targets, but it doesn't necessarily lead to achieving political control over human actions. Frederick Kagan asserts that "neither NCW nor "shock and awe" provides a reliable recipe for translating the destruction of the enemy's ability to continue to fight into the accomplishment of the political objectives of the conflict."¹³⁰

The technologies of NCW, precision, and standoff cannot create perfection in warfare. Their focus is on destruction of the enemy's forces and ability to command those forces; they do not focus on the problem of accomplishing political objectives. How the U.S. employs those technologies in the human context is the key to translating the efficiency of the technology into the effectiveness of winning the war.

Chapter 7

Conclusion

Technology may provide the tools for the prosecution of war, but it does not provide the solution. War is a violent conflict between or among state and state-like entities for political control over people, territory, or resources. Human beings create the entities that pursue war and controlling the actions of human beings is the ultimate goal of war.

Technology has been an integral part of prosecuting war since the first combatant picked up a rock to gain an advantage. The tendency to believe that better technology automatically wins may have come right along with that demonstrated advantage.

The tendency toward technocentricity is very strong, and is bolstered by the fact that resources are never unlimited. Several perceptions relating to constrained resources combine to favor a technological solution to problems. When considering a choice between paying for people or technology, military planners often look at personnel as a cost to be minimized. At the same time, planners will lean toward considering technological as pure capability. This line of thought is akin to a profit margin. Technology acquisition is capability acquisition and must be maximized, while personnel acquisition and maintenance are sunk costs and must be minimized. Any strategy that reduces people and increases technology is seen as good.

This same line of thought applies in the efficiency and effectiveness argument. Rather than acknowledge that war may require inefficiencies in order to increase effectiveness,

technocentric strategists assume away this problem with technological solutions. This line of thought assumes that technology provides a solution that is both efficient and effective at the same time. Solutions involving people are assumed to be both less inefficient and less effective than a technology solution.

Reinforcing this technocentric viewpoint is the strong impetus of casualty aversion. The logic of this position is this: not only do people cost more and provide less efficiency and effectiveness, but there are also dire consequences when we lose people.¹³¹ The loss of tons of equipment is acceptable, but the loss of a single life starts to eat away at what many military strategists see as our number one center of gravity; U.S. public opinion. With these synergistic mindsets, it is understandable how strategists fall into the trap of technocentricity. Build the right weapon and voila, you automatically win without shedding a drop of your own blood and with minimal damage to your enemy. You achieve the perfect war.

However, humans aren't machines and often don't follow the most obvious logic. The enemy has a vote in whether he is defeated. An enemy that refuses to play by the superior technology rules and disregards his own casualties may be able to circumvent his opponent's technology and inflict unacceptable losses. This is the heart of the asymmetric warfare argument. We are not worried that our opponent will out technology us, we are worried that our opponent will out think and out will us. The only way to ensure against the asymmetric opponent is to continue to produce warriors, to accept the cost and inefficiency of acquiring, training, and losing people, in order to gain the effectiveness that they bring to warfare.

Technology provides increased destruction, safety, and standoff that sometimes are the critical edge in winning wars. But technology does not win wars. The strategic

application of national power in the human context wins wars. It is ultimately the will to fight to win or resist. Human thought and emotion, not technology, are the essence of warfare.

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³⁵ Delmas, p. 3.

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³⁷ Sloan, p. 27.

³⁸ Jeffrey R. Barnett, *Future War: An Assessment of Aerospace Campaigns in 2010*, (Maxwell AL, Air University Press, September, 2004), p. xxi.

³⁹ The Russians now view parallel war with precision guided munitions as equivalent to nuclear attack and would retaliate with nuclear weapons.

⁴⁰ David S. Alberts, John J. Garstka, and Frederick P. Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority*, (DoD Command and Control Research Program, October 2003), p. 20.

⁴¹ Barnett, p. xxii.

⁴² Alberts, *Network*, pp. 89-90.

⁴³ Barnett, p. 111.

⁴⁴ Using technology to reduce the toll on human life in future war raises the question of how does one side impose it's will on the other? If we do not care that all of our robots are destroyed as long as our enemy's robots are unable to threaten us, have we been defeated? Although the desire to limit human suffering on both sides is a virtuous sentiment, it misses the point of going to war in the first place. We go to war to use violence and the threat of violence against human beings to coerce them into doing our will. The real threat of suffering and death are what make warfare work; unreasonably limiting enemy suffering limits the effectiveness of warfare.

⁴⁵ Howard, p. 13.

⁴⁶ Roland, p. 11.

⁴⁷ Max Boot, "The New American Way of War," *Foreign Affairs*, Vol. 82, No. 4 July-August 2003, pp. 49-50.

⁴⁸ Jeffrey R. Cooper, *Another View of the Revolution in Military Affairs*, (Carlisle Barracks, Pennsylvania: U.S. Army War College, 1994), p. 27.

⁴⁹ Benjamin S. Lambeth, *The Transformation of American Air Power*, (Ithica, New York, Cornell University Press, 2000), p. 303.

⁵⁰ Baron de Jomini, quoted by J. F. C. Fuller in *The Foundations of the Science of War*, (London, Hutchinson and Co. Ltd., 1926), p. 20.

⁵¹ Cooper, p. 30-31.

⁵² Alberts, *Network*, p. 21.

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- ⁵³ John Arquilla, David Ronfeldt, and Michele Zanini, "Information-Age Terrorism," *Current History*, Vol 99, Issue 636, April 2000, p. 180.
- ⁵⁴ David S. Fadok, *John Boyd and John Warden: Air Power's Quest for Strategic Paralysis*, (Maxwell AFB, AL, Air University Press, 1995), p. 43.
- ⁵⁵ Cooper, p. 30.
- ⁵⁶, Sam J. Tangredi, "Consensus Views," *All Possible Wars? Toward a Consensus View of the Future Security Environment, 2001-2025*, 2000, p. 90.
- ⁵⁷ Sloan, p. 68.
- ⁵⁸ Improving Proficiency for Irregular Warfare in the *National Military Strategy of the United States of America: A Strategy for Today; A Vision for Tomorrow*, 2004.
- ⁵⁹ *Bridging the Gap*, Defense Advanced Research Projects Agency, Report to the DARPATECH Conference, Anaheim, California, March 2004, p. 3.
- ⁶⁰ *CJCS Instruction 1800.01B*, 30 Jun 2004, Appendix D to Enclosure E. Previous edition Learning Area 6 was the Role of Technology in 21st Century Warfare. That Joint Learning Area is no longer included and no science or technology related learning areas are added.
- ⁶¹ Edward L. Katzenbach, Jr. states that "The intellectual problem of the military is to translate the characteristics of a piece of hardware—a gun, a machine, a vehicle—into a doctrine for its use, that is, to relate technological possibility to space and time, to mass, and to human psychology," in "The Mechanization of War, 1880-1919," in *Technology in the Twentieth Century*, Vol. II of Melvin Kranzberg and Carroll W. Pursell, Jr., editors, *Technology in Western Civilization* (New York, 1967), p. 549.
- ⁶² Holley, p. 144.
- ⁶³ Barnett, p. 15.
- ⁶⁴ *National Military Strategy*, p. 17.
- ⁶⁵ Hammond, *Mind*, p. 207.
- ⁶⁶ Col Phillip A. Meilinger, *Ten Propositions Regarding Airpower*, (Maxwell AFB AL, Air Force History and Museums Program, 1995), p. 20.
- ⁶⁷ Kagan, p. 5.
- ⁶⁸ Lt Col John P. Hunerwadel, "Planning to Win: A study in Strategy and Operational Art," *Air & Space Chronicles*, 26 February 2002.
- ⁶⁹ Draft of Joint Command and Control Functional Concept, Version 1.0 Draft, chapter 3 & 6, December 2003, Published 2003 by The Joint Chiefs of Staff.
- ⁷⁰ Barnett, p. xxiii.
- ⁷¹ Kagan, p. 15.
- ⁷² David S. Alberts, and Richard E. Hayes, *Power to the Edge: Command...Control...in the Information Age*, (DoD Command and Control Research Program, June 2003), p. 208.
- ⁷³ Alberts, *Power*, p. 226.
- ⁷⁴ Alberts, *Power*, p. 234.
- ⁷⁵ Bobbitt, p. 216.
- ⁷⁶ Fadok, p. 15.
- ⁷⁷ Guilmartin (Howard), p. 40.
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- ⁸⁴ Von Clausewitz, p. 95.
- ⁸⁵ Von Clausewitz, p. 101 and 119.
- ⁸⁶ Barry D. Watts, *Clausewitzian Friction and Future War, Revised Edition* (Washington DC, National Defense University, 2004), p. 66.
- ⁸⁷ Martin Van Creveld, *Technology and War: From 2000 B.C. to the Present*, (New York, Macmillan, 1991), p. 316.
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- ⁸⁹ Fadok, p. 15.
- ⁹⁰ Watts, p. 83.
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- ⁹² Hammond, *Mind*, p. 205.
- ⁹³ Bobbitt, p. 219.
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- ⁹⁵ Howard, p. 8.
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- ⁹⁸ Mao Tse-Tung, "On Protracted War: Why a Protracted War," 1938. Available on the Internet at http://www.marxists.org/reference/archive/mao/selected-works/volume-2/mswv2_09.htm, p. 237.
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- ¹¹⁰ Gray, p. 39.
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- ¹³¹ For a discussion of the pitfalls of casualty aversion, see "The Casualty-Aversion Myth" by Lt Col Richard A Lacquement, Jr. in the *Naval War Review*, Vol. LVII, No. 1, Winter 2004, pp. 39-57, (Naval War College Press, 2004).